NEED TO KNOW

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Evolution of a Program – The Electronic Combat System Integration

ECSI development team (from left to right) Jerry Scott, Lance Murri, Dave Harker, Greg Corbett, Kurt Welker, Mike Snyder and Kyle Schwieder pose with a vintage World War II bomber at Fanning Field, Idaho Falls, Idaho. The B-17 is a poignant reminder of how far modern warfare and aircraft have evolved.

Big programs sometimes start small. In 1988, the U.S. Air Force asked the INEEL to incorporate one of its electronic combat software applications into the Contingency Tactical Air Control System Automated Planning System (CTAPS), a command-and-control system being developed at the Laboratory.

As part of the CTAPS effort, National Security's Mike Snyder and Kurt Welker led the effort to integrate the application, Improved Many-on-Many (so called because it analyzes many radar systems against many jammers) into the CTAPS software suite. This required moving software from a VAX/VMS/Tektronix platform to a Digital Equipment Corporation/UNIX workstation and translating the programming language from FORTRAN to "C." Eighteen months later, IMOM was successfully incorporated.

Project completed, customer happy, end of story. Or it could have been. Instead, it was just the start.

The Air Force Information Warfare Center (AFIWC) liked how Snyder and Welker did business and liked what they did with the IMOM software. As a result, they established a relationship with the INEEL to continue the evolution of the software.

IMOM was originally created as an in-house model but was rapidly migrating to a widely distributed Air Force mission-planning tool. Changes in the software were needed to meet the changes in requirements. One requirement included integrating IMOM into Sentinel Byte, an intelligence and early-warning data program. Just as this effort began, hostilities in the Middle East flared and the Air Force asked the INEEL to make IMOM work with the Desert Storm Sentinel Byte configuration. The team responded and IMOM became a valuable planning tool during the Gulf War.

Both the Air Force and the INEEL recognized the limitations of IMOM. The CTAPS and Sentinel Byte efforts removed some of the proprietary platform restrictions but the translation to "C" introduced software maintenance concerns. The AFIWC and the IMOM user community requested functional enhancements to the model. And everyone wanted IMOM to run faster.

"Back in the early days of IMOM, an airman would load a

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couple hundred radars, start the application, then go home,” explained Mike Snyder of National Security’s Defense Systems. “When they’d come back in the morning, the analysis would be done.” But IMOM had proven itself in both exercises and real-world experiences so rather than abandoning it, the Air Force asked the INEEL to analyze IMOM from a software engineering perspective and help chart the path to the future.

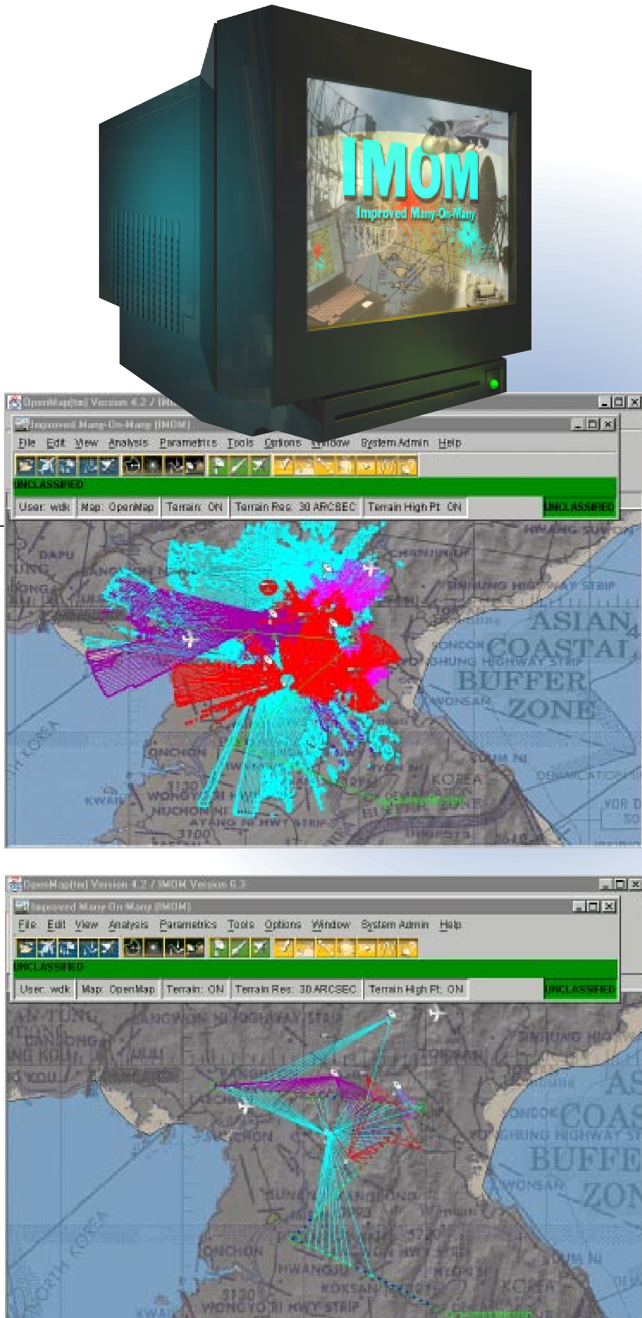
Could it be reengineered, salvaging some of the original investment or would it have to be scrapped and designed completely anew?

The INEEL project team recommended reengineering the software, with a new architecture including a new language – Ada – the then-Department of Defense standard. Their recommendations would enhance and extend the application’s life cycle.

In 1991, the INEEL began the reengineering. “Six months later, the customer came to us and said, ‘We like what you’re doing (with IMOM) but we need you to stop and bring three other applications up to speed,’” said Snyder. The other three applications, Reconnaissance (RECCE), Passive Detection (PD) and Communications Jamming (COMJAM), had an operating environment similar to the original IMOM product. Thus, Electronic Combat System Integration and its suite of computer models, was born.

The ECSI team had redesigned IMOM with reusable components. Like carburetors and alternators, the parts could be installed into the other applications, saving the customer time and money. In the final Ada version, the four applications contained 112 object classes or components, and 73 were shared.

The Ada versions ran on UNIX systems, which expanded the user community formerly restricted to VAX/VMS systems. With this expansion came more and more requests for upgrades. From using ‘stick’ maps that simply delineated political



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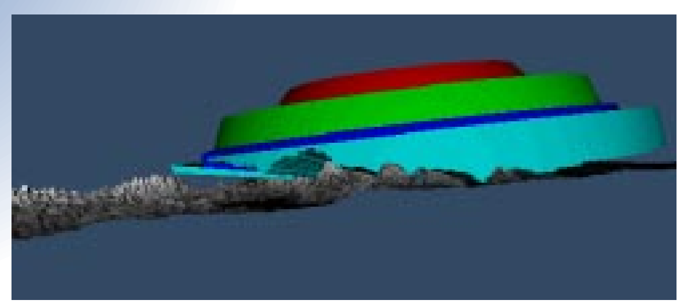
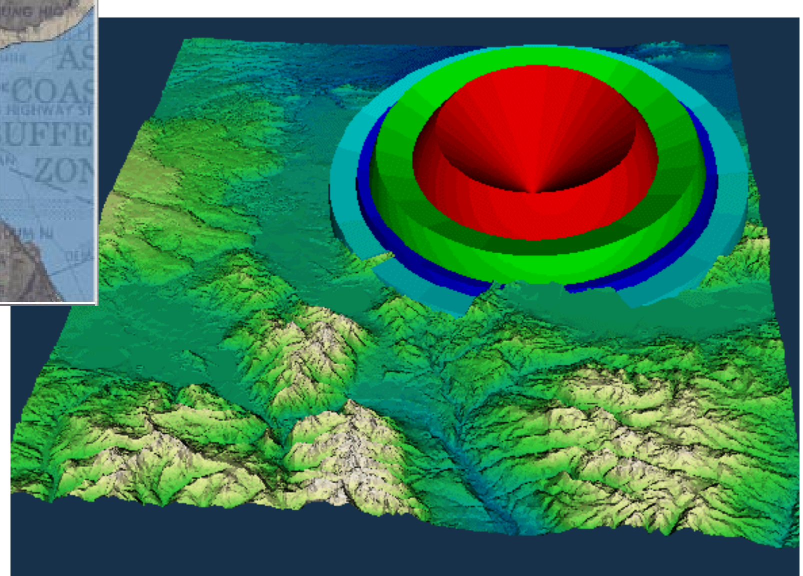
ECSI software is a family of Air Force computer programs that model electronic combat scenarios. The Improved Many on Many (IMOM) models radar systems to determine the range of hostile radar and weapons systems and effects of friendly jammer signals used against these radars.





boundaries, the new maps revealed the mountains and oceans of physical terrain.

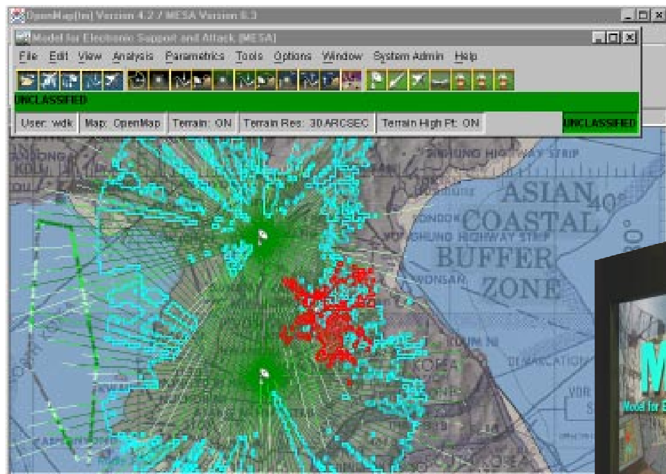
During the '90s, ECSI and the electronic combat world continued to evolve. The Air Force replaced CTAPS with the Theater Battle Management Core System, the Department of Defense stopped requiring Ada, and the World Wide Web was exploding. The INEEL software engineers incorporated ECSI into two more mission planning systems, the Combat Intelligence System and the TBMCS. They combined two applications, RECCE and COMJAM, into the enhanced MESA, Model for Electronic Support and Attack.

Emerging technologies and new requirements continued to drive the evolution of the ECSI software models. Requests for enhancements escalated and additional Department of Defense mission planning systems were requesting the models. The opportunity was ripe for another rewrite, this time to JAVA and C++.

Today, IMOM can be carried into the battlefield on a laptop computer. IMOM and MESA run on UNIX and Windows platforms with PD to follow shortly. Users range from aircrew to analysts. The models are distributed via CD or can be downloaded right from the AFIWC home page. The analysis of hundreds of radars takes only minutes.

By any definition, ECSI is a successful program. At the INEEL, workscope and funding has grown. ECSI has employed between four and five software engineers throughout the years and right now funds seven.

Over the years, the ECSI team has developed a number of spin-off products and technologies, including a suite of graphic user interface tools, a product to convert ASCII data from one format to another and a software maintainability assessment kit.



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The Model for Electronic Support and Attack (MESA) combines applications for communication and reconnaissance and predicts our ability to either electronically attack or support communication and radar sites.

"ECSI is one of the very few software projects in the world that has software maintainability metrics over its lifecycle – over thirteen years," said Welker. "Most people don't realize that software does wear out and break. This happens during the maintenance phase of the software lifecycle as bugs are fixed, capabilities are added, and changes are made in the operating environment. When maintainability is measured, then it can be managed and improved."

"It's teamwork that has made the ECSI the successful program it is," said Snyder. "And not just teamwork among the INEEL software engineers but between INEEL and the Air Force. The whole team has shared a common vision to accomplish the Air Force goals and objectives. We've cultivated business relationships and developed friendships. It all boils down to good people doing outstanding work."

ECSI is more than a model of electronic combat software. It is a model of a successful program.

IMOM – MESA – Passive Detection –

The new face of modern warfare and protection

The Electronic Combat System Integration software is a family of Air Force computer programs that model electronic combat scenarios supporting mission planning and analysis. Modern warfare is conducted with sophisticated detection and communication systems. Survival is dependent on knowing where those systems are and the range of their detection and operation.

The ECSI applications use colorful, two-dimensional graphics to display analytical scenarios. Flight paths, weapon and radar ranges, and jamming capabilities are all shown within the different systems using easy-to-interpret figures. These high-tech graphics give the users the same comfort level and familiarity as they've had with years of maps, graphs and markers. But unlike the old, time-consuming, manual methods, ECSI analyses typically take just minutes.

Using Intelligence data and Order of Battle information, ECSI applications can be run for any location in the world.

IMOM models radar systems. Pilots and mission planners use the software to determine the range of hostile radar and weapons systems and to model effects of friendly jammer signals used against these radar systems. With this information, they can plot a route to avoid detection altogether or mitigate the risk through countermeasures.

Pilots and planners can run different scenarios that include added potential countermeasures. Would the aircraft be detected at lower altitudes? What are the effects of a jamming aircraft flown in the vicinity?

IMOM constructs detection rings for airborne radar and detection contours around search/tracking/threat areas of vulnerability. It also analyzes the aircraft route. IMOM can

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complete a Suppression of Enemy Air Defense (SEAD) analysis that consists of either a radial analysis (where do I need to be to launch my SEAD weapon?) or footprint analysis (what can my SEAD weapon hit from this location?).

IMOM isn't just a theoretical planning tool. IMOM is battle-tested. During the Gulf War, U.S. pilots used the system and it passed muster with flying colors.

MESA combines two previous applications for communications and reconnaissance. MESA was created to predict our ability to either electronically support or attack communication and radar sites. It can also be used to display allied communications ranges so pilots will know when they are in – or out – of radio contact.

Rod Peltier, AFIWC program manager, explained the significance. "Missiles are fired after a release authority is given. Release authority can be done by voice or radio. If we disrupt this link, the enemy can't get the authority to launch. Also, information on passing targets is sent from early warning systems to anti-aircraft weapons through communication links. Anytime we can disrupt communication links, it helps."

In trying to gather information on radars, it is vital to detect them before they detect you. MESA models how well a receiver can collect an emitter's signature within a geographic area or along a planned route. It also displays details regarding the ability to communicate with or without jammers present. Reconnaissance planes use this information to plan missions to collect as much information or signals as possible without themselves being detected. As with IMOM, the results can be displayed graphically or in a text file.

Radars are active collectors. That is, they emit energy. They send out waves that bounce off targets and send back information. Passive detectors sit quietly and listen; they do not emit energy. They listen for the electronic footprint of aircraft. Aircraft altimeters and electronic navigation emit signals that the passive detection systems collect. The Passive Detection model predicts the ability of a passive detection network or group of receivers to detect and locate radio frequency emissions. It also produces both graphical output and reports.

"Intelligence can use this information to brief a pilot going into combat," said Peltier. "Sometimes, they have no choice. The route is set and they will be 'in harm's way'. But it's nice to know what's out there."

ECSI provides a formidable suite of high-fidelity software models that improve the capability of U.S. military activities and help ensure survivability of our servicemen. National Security's ECSI Program has proudly played a key role.

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State of the Division

Laurin Dodd,
Associate Laboratory Director, National Security

The INEEL is experiencing much change. Initiatives are under way to improve operating efficiencies and to better match staffing levels and skills with our future needs. The departure of some key staff, organizational realignments at all levels, and changes in service support will challenge all of us to take on more responsibilities. I am optimistic that successful transition through this period of change will result in an organization that is better positioned for success.

Today there remains continued uncertainty about the DOE Environmental Management (EM) funding levels for FY-02. Although EM Programs is the major funding source for the INEEL, it is not a direct funding source for National Security programs. However, significant reductions in EM funds would directly impact the size of our Laboratory Directed Research and Development (LDRD) budget. They would have some impact on our indirect budgets, and would reduce the participation of Division staff in site-funded work. We remain hopeful about next year's budget, but we need to recognize that additional challenges may lie ahead.

We should all be pleased about the success that the Division has experienced in the last year. We have been challenged to grow our externally-funded business at a rate of 5 percent per year, and we are on track to meet that growth this year. I am optimistic that by working together, we can continue that growth rate, and just as important, increase our contributions toward solving problems of national and international importance.

We have announced a realigned structure for the Division. The new structure increases our focus on external markets and provides a better balance between organizations in terms of stable business base and growth opportunity. As with any organizational alignment, there will be refinements in the future.

Let us not lose sight of our mission as we move forward with these changes. Our primary responsibility remains with meeting program and project commitments. The ECSI profile in this issue continues to emphasize that it is in succeeding for our customers that we ourselves shall succeed.

Defining Excellence –

Modeling, Simulation and Visualization

This article is a continuation from the April 2001 issue demonstrating how the National Security Division uses advanced computing to support Department of Energy objectives.

Models, such as this 3D aircraft created by Lyle Roybal, are used to predict behavior, and offer a safer alternative to untested performance.

Modeling –***A mathematical or physical system, obeying certain specified conditions, whose behavior is used to understand a physical, biological or social system to which it is analogous in some way.***

Forms of modeling vary almost as much as the types of projects that employ them. Physical system modeling mirrors a process; geometric solid modeling portrays an object.

Lyle Roybal has used many types of modeling at the INEEL and for other organizations, but some of his most dramatic projects used 3D model mock-ups. Roybal has modeled reactors, missiles, satellites and jets. At first glance, the model appears to be a photograph, but on closer examination the viewer sees the angles, planes and shapes of a computer mock-up. What the viewer does not see is that these models are truly multidimensional; beneath the skin lie vital components necessary for the object's performance.

The models are used to predict behavior. Reactor modeling is used to predict failure. Other models, such as those for weapons, predict success. Both offer a safer alternative to untested performance. From the information provided by the model comes the code that runs, guides and rules the object.

Not all modeling is as visually exciting as the geometric solid modeling. Sometimes modeling just results in better, safer and quicker ways of doing business.

Employees at Fernald Environmental Management Project in Ohio are using sodium iodide and germanium spectrometers to measure contamination. The instrument measures counts per second. Physicists at FEMP have developed models to turn these counts per second into isotopical concentrations. Roybal is implementing these models through algorithms with results available on a real-time basis. The process has valuable applications at INEEL and around the DOE complex.

Where the old process took four to five days for contamination results, radiation physicists and technicians now obtain that same information in real time. Instead of sending 100 or more samples to a lab for expensive and time-consuming analysis, the technicians can target appropriate areas and select a handful of more meaningful sample locations.

This technology is currently being used at the Idaho Nuclear Technology and Engineering Center to aid in a decontamination and decommissioning project.

In spite of his important contributions to environmental management, Roybal is probably best known at the INEEL for his work with National Security technologies. The Rapid Geophysical Surveyor and the Concealed Weapons Detection system are highly successful and nationally known. Both the RGS and the CWD have spun out to commercial enterprises and Roybal holds a patent on the weapons detection system.

The RGS is the primary survey tool for Idaho Falls small business Sage Earth Sciences and has been marketed nationally and internationally. Recently, an RGS system was included in the Transportable Munitions Assessment System sent to Greece to help with the discovery and destruction of obsolete weapons.

The Concealed Weapons Detector received national attention when it was installed in Bannock County Courthouse. Although these two inventions appear outwardly distinct, Roybal points out the similarities. "They both basically use the same sensor technology. With the Surveyor, the sensors move over the target. With the Weapons Detector, the target – people – move through the sensors."

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High-Performance Computing (Supercomputing) – ***Numerical simulation of physical problems***

Modeling, scaling, artificial intelligence and visualization are tools scientists and engineers use to understand, shape and control the physical world. All are dependent on computers. The bigger the problem you want to solve, the larger the computer you need. But how big is big? How large is large?

According to Eric Greenwade, group leader of the Numerical Simulation Laboratory, large is a relative idea. "Large means different things to different people. I'll define large data sets (problems) as those we can barely handle."

His definition is based on what he calls 'a pain threshold.' People are willing to wait a certain amount of time for an answer or response. A Web surfer may be willing to wait a second or two for a browser to respond. Scientists running large-scale simulations might be willing to wait three weeks, months or

See **COMPUTING**, *page 6*

Eric Greenwade stands with one of the newest multi-processors, also known as a classic supercomputer. The Numerical Simulation Laboratory has a number of high performance computer platforms available for use by INEEL scientists and collaborators.

COMPUTING *(continued from page 5)*

years for an answer. It's a Catch-22 process. If you increase the amount of the hardware to speed the process, scientists will increase the size of the problem.

So while Greenwade leads some of the most advanced visualization and modeling efforts being conducted at the Laboratory, he makes his greatest impact with supercomputing.

David and Goliath

Say supercomputing and the mind's eye sees antiseptic rooms of giant, humming machines, served by white-coated scientists and programmers. Greenwade has these kinds of supercomputers; busy processing 50 gigabytes per second in air-conditioned, filtered rooms. But he also has supercomputers of the more mundane type — a gaggle of PCs, called cluster computing.

"It's more ying/yang than David and Goliath," said Greenwade, speaking of the relationship between clusters and symmetric multi processors (SMPs), the classic supercomputer. "It's not adversarial, but complementary." Clusters, although vastly cheaper than even the most bargain-basement supercomputer require much more of an investment in time. Computer engineers need to know the details of the hardware, networks, operating system, applications and simulation code before they can begin to draw the computing power from the linked systems. SMPs handle all that automatically. But at $1.5 million for an SMP versus less than $100,000 for a cluster, it's a worthwhile learning curve.

Greenwade runs about half of the mathematical problems on clusters but he says only 10 percent of them run really well. He is focusing on how to make them run better. For the last three summers he has mentored talented computer science students in Beowolf-class cluster computing. He sees the future of scientific computing in understanding the true capabilities of clusters. "All the money in the world won't buy the supercomputing power we will need," says Greenwade.

The Big Picture – Jpeg

Some of the most valuable contributions Greenwade makes to the INEEL are not even done at the INEEL. Greenwade serves as official U.S. representative to the International ISO JPEG and MPEG Working Groups and is one of the authors of JPEG-2000's Annexes E, F and G. JPEG-2000 is intended to create the state-of-the-art compression for the next 10 years. While the novice computer user recognized .jpg as a format for photos sent over the Web, Greenwade explains its real purpose and value.

"In high-performance computing and particularly in visualization, we end up with very, very large amounts of data. That data needs to be processed efficiently and it needs to be moved around."

The concept of data compression is easily understood with the example of a photograph, scanned and e-mailed. During the wildfires last summer, a spectacular photograph of cow elk was taken by a firefighter and mailed around the world. The photo may comprise 1 or 2 megabytes of raw information. If you compressed that image to one-tenth, one-twentieth or one-hundredth of its original size, you could ship it faster, more frequently and with less impact to the infrastructure.

Some of the same techniques that are used to transmit data effectively via compression also help to process data effectively. Greenwade and the JPEG Working Group set the standards for the next generation of hardware, promoting the types of features that will support scientific work.

The standards body includes representatives from the

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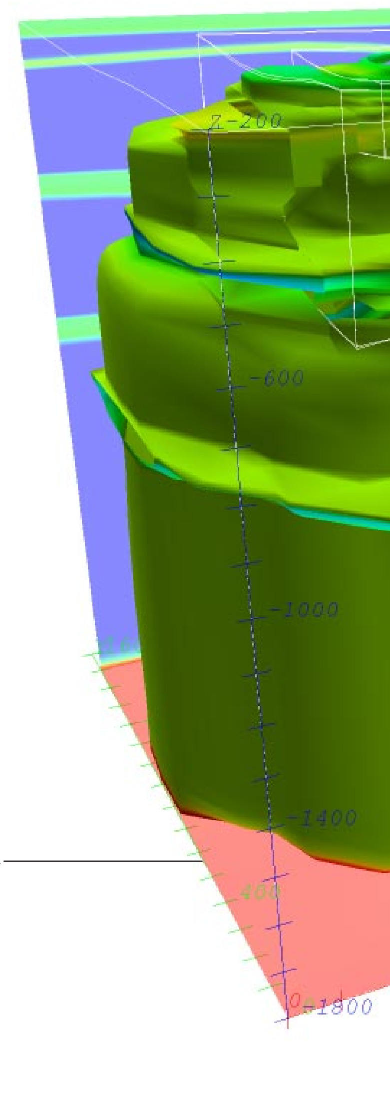

hardware developers – Adobe, Sony, Kodak, Ricoh, Sharp, Cannon, etc. Greenwade's participation gives the INEEL a keen competitive edge. "We often know at least two years in advance what these capabilities are going to be and what the rest of the community is moving towards."

*Wave*lets *of the Future*

The new compression schemes offer other significant advantages to researchers over the old Fournier-Transform-based techniques in that they are hierarchical. For example, analysts looking at contaminant transport data can set up the representation so that data they are most interested in comes first. The analyst can then very, very quickly scan through the remainder. The compression scheme can be tuned to be sensitive to the data researchers are interested in because the important characteristics have been set up to represent the higher order of the coefficient.

The hierarchical approach is a tremendous advantage when the output is known and no disadvantage if it is unknown. These techniques are based on wavelets that focus on sharp changes. Humans see objects by edges and hear by changes in pitch. These sharp changes, non-differentiable jumps in data, are well-represented by wavelets and they do it at the first part of the file.

Greenwade is putting together all of these aspects – visualization, high-performance computing, data compression and transmission – into what he calls an interactive, collaborative environment.

Greenwade sees the future of scientific computing in understanding and developing the true capabilities of clusters.

Researchers collaborating on projects today often don't sit in side-by-side cubicles or even side-by-side laboratories. INEEL researchers work with other DOE laboratories, regional and national universities, and more and more frequently, scientists from around the world.

Greenwade's group is developing a system where colleagues can share images and test results while still retaining ownership of sensitive data. In real time, they can examine models, change parameters and discuss consequences as if they were sitting around the same workstation. Their first test of the system is scheduled for summer when they will be implementing a test version to visualize subsurface science data.

"This will be a tremendous tool for stakeholders," says Greenwade, who presented an invited paper on the concept in Tokyo this last April. "People are hesitant to accept everything at face value. They want to ask the question, 'Have you looked at this from a different perspective?' This type of tool can send the science right into the conference rooms."

Greenwade travels constantly; presenting invited papers, presiding over technical conferences and helping establish the next generation of standards. In Idaho, he leads his group in the creation of otherworldly visualization models grounded in the most fundamental science. In his spare time, he mentors new talent and explains computer games to children on PBS. And with each one of these activities, the INEEL benefits.

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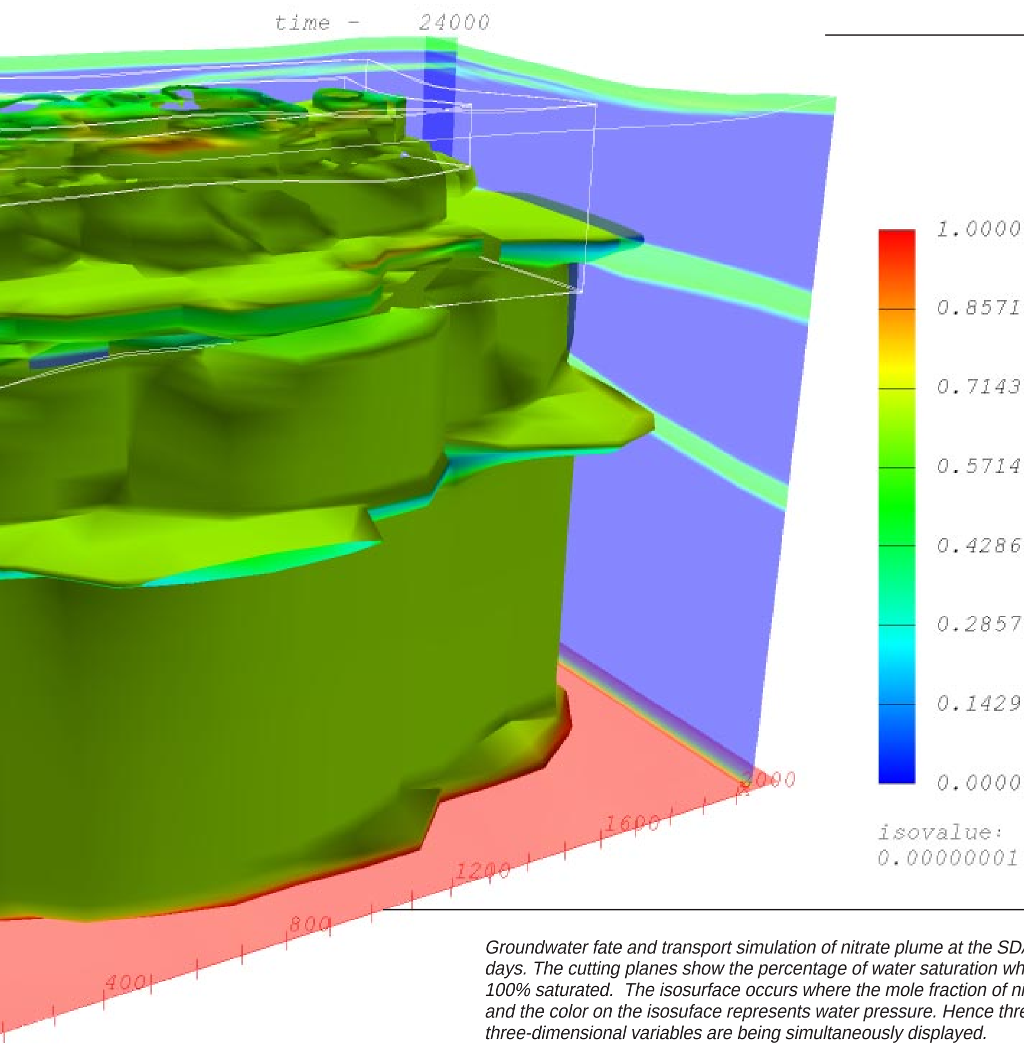

Groundwater fate and transport simulation of nitrate plume at the SDA after 24000 days. The cutting planes show the percentage of water saturation where red is 100% saturated. The isosurface occurs where the mole fraction of nitrate is 1.0e-8 and the color on the isosuface represents water pressure. Hence three separate, three-dimensional variables are being simultaneously displayed.

INEEL researchers (from left to right) Ed Reber, Rahmat Aryaeinjad, Dale Kotter and James Jones demonstrated the capabilities of three INEEL-designed technologies at the Radiation Rodeo held at the Nevada Test Site.

Radiation Rodeo

The town of Mercury, Nev., appears on very few maps. Mercury sits on the 1,375 square-mile Nevada Test Site. During the height of the Cold War, whole families lived there while workers were busy building and testing nuclear weapons. But now its stores are closed and movie theater shut down. Its heyday was over decades ago. The mission has changed at the Nevada Test Site as at many Department of Energy locations.

Now employees conduct hazardous chemical spill testing, emergency response training, conventional weapons testing, and waste management and environmental technology studies.

But for a few days this last April, Mercury came alive again and its living quarters were filled with scientists and researchers from around the country. It was the Radiation Rodeo.

The hand-held gamma neutron detector was one of the three technologies brought to the competition. INEEL researchers also demonstrated a bench-top, fast neutron gamma sensor and a neutron-source detection system.

Like a rodeo where cowboys compete under tough conditions to test their skills, scientists from around the DOE complex assembled in Nevada to test theirs. But instead of riding, roping and bulldogging, these researchers were testing some of the most advanced radiation detection systems in the world. Dale Kotter, James Jones, Rahmat Aryaeinejad and Ed Reber brought three different INEEL-designed technologies for the competition – the hand-held gamma neutron detector; a bench-top, fast neutron gamma sensor; and the neutron-source detection system.

"We designed these systems on paper and in the lab," said Kotter, who brought the sensor. "It's a great opportunity to see how they perform in real-world conditions."

The tests themselves were designed and planned months in advance and conducted with the precision of a military exercise. Because actual special nuclear material was used, security was in full force. Participants were cautioned that "deadly force was authorized" to protect the material.

The tests were staged at two locations – one a dry lake bed code-named Area 5 lying 15 miles from Mercury and the other, the 100,000-square-foot Device Assembly Facility.

Overall purposes of the tests were to demonstrate the capabilities of existing systems and to identify any technology gaps where future research funding must be directed. Specifically, the goal of the outdoor test was to determine how far each of the instruments could detect a radioactive source, and the goal of the indoor test was to assess the system's accuracy in identifying material type and isotopic composition of the source.

In the field

Many of the DOE labs fielded teams and each team set up its instrumentation within a specified quadrant with the source as the epicenter. Flags delineated borders of the quadrants and for the most part, the labs respected them.

In addition to the immobile detection instruments, vehicles crawled by and aircraft flew over, testing movable, ground-based and air-based systems.

Officials changed the source or configuration twice a day. Researchers continued to move their instrumentation further from the source until detection was no longer possible. At the end of each day, they logged test data into a standard format. Nevada Test Site personnel will analyze the results and benchmark the technologies.

"There are both risks and benefits to the competition," says Kotter. "It's a great opportunity to market INEEL technologies to the customer, that is, of course, if you do well. Fortunately, we were very competitive in our measurements. We were all very pleased with the preliminary results from our systems."

In the DAF

The Device Assembly Facility offered a safe and secure indoor location for testing radiation detection devices with actual SNM. Built in the mid-1980's at an approximate cost of $100 million, the 100,000-square-foot DAF was constructed to consolidate all nuclear explosive assembly functions, to provide safe structures for high explosive and nuclear explosive assembly operations, and to provide a state-of-the-art safeguards and security environment.

"During the outdoor tests, the SNM was always in shipping containers and masked from weather or spy satellites. Indoor tests offered the opportunity to analyze the material in its most unrestricted form," explained Kotter. "We learned a tremendous amount about the isotopes for further diagnostic testing."

While the researchers hovered over their instruments, agency representatives from DOE, the Federal Bureau of Investigation, Secret Service, Customs, Environmental Protection Agency, Department of Defense and the Atomic Energy Authority — England's version of DOE — observed and asked questions.

Mingling with these representatives presented a worthwhile marketing opportunity for the four INEEL scientists. The Radiation Rodeo, however, was much more.

According to Kotter, the event offered an open environment to discuss applications, provided valuable lessons learned from each device's successes and limitations, and helped them establish key contacts with users.

These benefits came at a personal price – breakfast was served beginning at 3 a.m., lunch was in the field and the evenings were spent preparing for the next morning's Plan of the Day meeting. The initial briefings warned the field testers of the "hostile, desert terrain, which includes scorpions and snakes."

"It was a tremendous experience," says Kotter, snakes and scorpions aside. "Our systems were very competitive and we're looking forward to the final report. They are beginning to plan Rodeo II and we'll be there."

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Achievements, Accomplishments and Acknowledgments

- The PINS Team of Gus Caffrey, Brian Harlow, Andy Edwards, Ken Krebs, Ed Seabury, and Steve Frickey received an INEEL Spirit of Excellence Award for their swift and successful response to an emergency within the city of Idaho Falls. After a homeowner found an old gas cylinder in his garage with "chlorine" stenciled on the side, the Idaho Department of Environmental Quality needed confirmation of the contents before it could dispose of the cylinder. Within minutes of operation, the PINS team was able to positively identify the contents without opening the container and further endangering citizens or the environment. PINS was also featured in the June issue of *Pollution Engineering* in an article on its use at the INEEL to identify the contents of several unmarked cylinders. The full article can be seen at www.pollutionengineering.com.

Ken Krebs assembles the PINS system in the backyard of an Idaho Falls, Idaho home. PINS was used to safely and accurately identify the contents of an old gas cylinder found by the homeowner in his garage.

- National Security hosted the Tactical Mobil Robotics Quarterly Interim Program Review for the Defense Advanced Research Projects Agency. Lt. Col. Douglas Dyer wrote to Associate Laboratory Director Laurin Dodd, "…The location proved ideal for our purposes, allowing the attendees to completely focus our time and energy on the TMR program, with the added benefit of placing our scientists and developers in contact with the outstanding and impressive engineers at the INEEL… I would like to especially commend both Mr. Michael Occhionero and Mr. Julio Rodriguez for the innumerable hours of preparation and coordination they provided …The conference was aptly planned, exceptionally well coordinated, and smoothly executed. Particularly noteworthy was their attention to the finest detail. In addition, my gratitude to both Ms. Diane Teunessen and Ms. Cathy Glavin whose outstanding support provided a most welcomed assist."
- The Idaho State Police recognized the CrimNet team for outstanding support. Lt. Col. Glenn Ford wrote to program manager Bob Polk "…It appears that we have finally reached another of our benchmarks in this project, however, none of it would have been possible without the dedication and sacrifices exhibited by your team…Doug Colonel, Bobbi Larsen, Dale Handy, and Dave Schwieder worked on personal time when we were having problems with the server. Dan Jensen worked on his days off and weekends... In February, on several occasions, while his wife was driving to their son's basketball games, Dan would use the laptop to continue working on this project. And finally, you have been most supportive throughout this entire project… For all of you

who have worked on this project, please extend my acknowledgement and sincere appreciation for the sacrifices they made to make this project successful. As a result, Idaho will truly be a safer place to live."

Gail Cordes was elected Chair of the American Nuclear Society Human Factors Division for 2001-2002 (above). As Vice-Chair of the Project Management Institute, Becky Winston spoke to project management professionals, university students and professors during a recent tour of Argentina and Brazil (right).

- Becky Winston, in her continuing role as Vice-Chair for the international Project Management Institute, was invited to deliver a talk in Belo Horizonte, Brazil, to over 300 project managers and their executive management. The talk centered on the growth of the profession, certification, and the need for project managers in a competitive and often volatile business environment. While at the engagement, she was interviewed by several business magazines in Brazil including *Sucesu*. From Brazil, Winston traveled to Buenos Aires, Argentina, where she attended a meeting of the Executive Committee of the PMI, Inc. Board of Directors. There, she spoke to the Buenos Aires Chapter and other business leaders on career management for project managers. The final stop on the tour was Rio de Janeiro, Brazil, where she first spoke to 200 masters of business administration and engineering students and their professors at the University of Rio de Janeiro on the profession of project management, and then at a meeting hosted by Price Waterhouse on the need for certification in the global marketplace.
- Gail Cordes has been elected Chair of the American Nuclear Society Human Factors Division for 2001-2002. Cordes has held many positions in the ANS. She has served twice as a member on the National Board of Directors and one term as a member of the National Executive Committee and has been elected treasurer, vice chair, chair and director of the Idaho Section.
- Ron Ayers was selected by the Department of Energy as one of the four members of the U.S. technical team for the three site visits under the Russian Research Reactor Fuel Take Back Initiative.
- Eric Greenwade and May Chaffin submitted an invited paper titled, "Geographically Distributed Collaborative Environments" at the SUPerG conference in Tokyo, Japan. Greenwade was one of two Capstone invited speakers at the conference and presented the paper.
- Gus Caffrey presented a paper entitled "High Explosive Identification by Neutron Interrogation" at the Russian-U.S. Technical Interchange Meeting on Warhead Safety and Security During Dismantlement in Snezhinsk, Russia.
- Keith Daum's research paper, "Resolving Interferences in Negative Mode Ion Mobility Spectrometry Using Selective Reactant Ion Chemistry" was published in *Talanta* in April.
- Louis Wilder received his bachelor of science degree in computer science from the University of Idaho in May.
- John Morrison received a patent on "Method and Apparatus for Monitoring the Integrity of a Geomembrane Liner Using Time Domain Reflectrometry."
- Scott Bauer, Kerry Klingler, Thor Zollinger and Charles Isom submitted a patent disclosure on "Ultrasonic Delays for Use in Explosive Environments."
- John Slater, Thomas Crawford and Dean Frickey received a patent on "Apparatus Configured for Identification of a Material and Method of Identifying a Material."
- Stacey Barker received a royalty check for the ROADSPIKE technology. ROADSPIKE has now been sold in 26 countries.
- John Svoboda, Richard Hess, Dave Harker and Reed Hoskinson submitted a patent application on "Systems and Methods for Employing Opportunistic Data Transfer to Create Dynamically Mobile Data Communication Systems."
- Paul Mottishaw and David Atkinson submitted a patent application on "Simultaneous Vaporization and Ionization Source for Particulate Matter Analysis by Ion Mobility Spectrometry and Atmospheric Pressure Ionization Mass Spectrometry."
- James Jones, Gordon Lassahn and Greg Lancaster have submitted a patent disclosure describing the change detection system.
- Thomas Hickman submitted a patent disclosure on a mitigation method for protection of overhead utility lines.

The Insider Threat

Contributed by: Bruce Allbright

Intelligence collection is escalating around the world and American core technologies are the primary target. Espionage can occur from an insider or an outsider. This article addresses the insider threat.

Insiders are people we trust. Many have security clearances and many are high performers.

Employees and contractors — whether citizens or foreign nationals — who have access to INEEL resources can intentionally or unintentionally expose information and provide access to unauthorized individuals.

Unintentional indicators are sharing passwords, sharing resources on the network, improper escorting of visitors, inappropriate e-mails, or similar activities. Intentional indicators are attempts to obtain information without a need to know, excessive use of copying equipment, unauthorized removal of classified/sensitive unclassified information, or similar activities.

According to a survey taken between 1988 and 1994, approximately 75 percent of all reported incidents of economic espionage were attributable to employees or former employees with access to sensitive information. In cases involving national security between 1975 and 2000, the United States charged 140 individuals with espionage. Of these, 80 were U.S. citizens with security clearances, 35 were U.S. citizens or resident aliens with no security clearance, and the remaining 25 were foreign nationals.

Why do people decide to betray their country or company? Nearly all motivation can be grouped into four categories – money, ideology, ingratiation, and disgruntlement. Of these four, money (the most common motive) and disgruntlement appear to be increasing as reasons for betrayal. Ideology and ingratiation are declining. Although it is tempting to put motivation for spying into neat boxes, as with any human activity, the real reasons are generally far more complex than simply money or ideology.

According to the American Society for Industrial Security, U.S. Fortune 1000 companies lose more than $45 billion worth of proprietary information to theft each year. The number of reported incidents of theft grows each year.

The INEEL has been fortunate to not have any reportable incidents during the past decade. But espionage activities designed to steal secret and/or proprietary information from our government and our country's industries/businesses are as intense as ever. INEEL employees must always be vigilant of their surroundings and their actions.

Remember JDLR. Contact your Counterintelligence office, 526-2223 or the Security office, 526-0952, if you have any questions or concerns. For more information about espionage, check out the INEEL Counterintelligence internal Web page.

Insiders are said to be responsible for approximately 75 percent of all reported incidents of economic espionage.

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